System integration of the Silicon Tracking System for the CBM experiment at FAIR

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**System concept**

- **STS** is the central tracking detector in CBM
  - 8 tracking stations
  - ~4 m² active area

- **Integration, operation, maintenance**
  - confined space in the dipole magnet
  - 2 m³ of volume
  - module assembly and attachment
  - ladder construction and attachment
  - cooling of the sensors (~5 °C)
  - cooling of the front-end electronics
  - power dissipation: 40 kW (two thin layers)

**Components**

- **Ladders**
  - 106

- **Modules**
  - 896

- **Sensors**
  - 1220

- **Cables**
  - 14336

- **Cable lengths**
  - 15 cm – 60 cm

- **Cable channels**
  - 1835k

**Double-sided silicon sensors**

- 1024 channels (58 µm strip pitch)
- 300 µm thickness
- strip lengths 2, 4, 6 and 12 cm
- stereo-angle 7.5°

**Self-triggered front-end electronics**

- STS-XYTER
  - 128 channels (8 per side)
  - two rows for bonding
  - power dissipation < 5mW/channel

**Low-mass micro cables**

- 128 channels (8 per side)
  - two layers, tap bonding

**Ladders**

- lightweight carbon-fiber space frames with end supports
- ladder comprises two times five modules
- one-cycle polymerization at 125 °C in a metallic mold
- modules are attached using legs

**Module and ladder assembly**

- tab bonding of 64 channels (first cable layer) to chip
- tab bonding of 64 channels (second cable layer) to chip
- tab bonding of the cables to sensor
- connectivity tests
- populating first FEB with 8 STS-XYTER chips (p-side)
- populating second FEB with 8 STS-XYTER chips (n-side)
- functionality and QA tests

**Cooling system**

- STS read-out electronics dissipates ca. 40 kW (212 FEE blocks of 200 W)
- cooling with bi-phase CO₂ (2-phase accumulator controlled loop)
  - high efficiency at small spatial requirement
- standard for tracker upgrades at LHC
- cooperation of GSI with CERN: TRACI-XL

**Technical Design Report available at:**
http://repository.gsi.de/record/54798

**Cables routing**

- Mockup

**Underground hall:**
- Length: 37 m
- Width: 22 m
- Height: 17 m